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Approved for use through 10/31/2002 OMB 0651-0032

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# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 2028-174  
First Inventor Mark J. Kittcock  
Title Fluid-Moving Device With A Clearance Seal  
Express Mail Label No. EL399426228US

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

- ☒ Fee Transmittal Form (e.g., PTO/SB/17)  
(Submit an original and a duplicate for fee processing)
- ☐ Applicant claims small entity status.  
See 37 CFR 1.27.
- ☒ Specification [Total Pages 11]  
(preferred arrangement set forth below)
  - Descriptive title of the invention
  - Cross Reference to Related Applications
  - Statement Regarding Fed sponsored R & D
  - Reference to sequence listing, a table, or a computer program listing appendix
  - Background of the Invention
  - Brief Summary of the Invention
  - Brief Description of the Drawings (if filed)
  - Detailed Description
  - Claim(s)
  - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 3]
- Oath or Declaration [Total Pages 3]
  - ☒ Newly executed (original or copy)  
Copy from a prior application (37 CFR 1.63 (d))  
(for continuation/divisional with Box 17 completed)
  - ☐ **DELETION OF INVENTOR(S)**  
Signed statement attached deleting inventor(s)  
named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
- ☐ Application Data Sheet. See 37 CFR 1.76

ADDRESS TO: Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

- ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
  - ☐ Computer Readable Form (CRF)
  - Specification Sequence Listing on:
    - ☐ CD-ROM or CD-R (2 copies); or
    - ☐ paper
  - ☐ Statements verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

- ☒ Assignment Papers (cover sheet & document(s))
- ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☒ Power of Attorney
- ☐ English Translation Document (if applicable)
- ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
- ☐ Preliminary Amendment
- ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
- ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
- ☐ Other: .....

17. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)

of prior application No.: \_\_\_\_\_ / \_\_\_\_\_

Prior application information:

Examiner: \_\_\_\_\_

Group / Art Unit: \_\_\_\_\_

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

## 18. CORRESPONDENCE ADDRESS

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Name (Print/Type)

Gary T. Hampson

Registration No. (Attorney/Agent)

29,929

Signature

*Gary T. Hampson*

Date October 09, 2000

Burden Hour Statement This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

# FEE TRANSMITTAL for FY 2000

Patent fees are subject to annual revision

**TOTAL AMOUNT OF PAYMENT** (\$) 730

## Complete if Known

Application Number \_\_\_\_\_  
 Filing Date October 10, 2000  
 First Named Inventor Mark J. Kittock  
 Examiner Name \_\_\_\_\_  
 Group Art Unit \_\_\_\_\_  
 Attorney Docket No. 2028-174

## METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number 02-1660  
 Deposit Account Name Beckman Coulter, Inc.

- ☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17  
☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☐ Payment Enclosed:

☐ Check ☐ Credit card ☐ Money Order ☐ Other

## FEE CALCULATION

### 1. BASIC FILING FEE

Large Entity	Small Entity	Fee Code	Fee (\$)	Fee Code	Fee (\$)	Fee Description	Fee Paid
101	201	690	345			Utility filing fee	\$690
106	206	310	155			Design filing fee	
107	207	480	240			Plant filing fee	
108	208	690	345			Reissue filing fee	
114	214	150	75			Provisional filing fee	

**SUBTOTAL (1)** (\$) 690

### 2. EXTRA CLAIM FEES

Total Claims	Extra Claims	Fee from below	Fee Paid
11	-20** = 0	18	0
Independent Claims	2	-3** = 0	78
Multiple Dependent			

\*\*or number previously paid, if greater; For Reissues, see below

Large Entity	Small Entity	Fee Code	Fee (\$)	Fee Code	Fee (\$)	Fee Description
103	203	18	9			Claims in excess of 20
102	202	78	39			Independent claims in excess of 3
104	204	260	130			Multiple dependent claim, if not paid
109	209	78	39			** Reissue independent claims over original patent
110	210	18	9			** Reissue claims in excess of 20 and over original patent

**SUBTOTAL (2)** (\$) 0

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

Large Entity	Small Entity	Fee Code	Fee (\$)	Fee Code	Fee (\$)	Fee Description	Fee Paid
105	205	130	65			Surcharge - late filing fee or oath	
127	227	50	25			Surcharge - late provisional filing fee or cover sheet	
139	139	130	130			Non-English specification	
147	147	2,520	2,520			For filing a request for <i>ex parte</i> reexamination	
112	112	920*	920*			Requesting publication of SIR prior to Examiner action	
113	113	1,840*	1,840*			Requesting publication of SIR after Examiner action	
115	215	110	55			Extension for reply within first month	
116	216	380	190			Extension for reply within second month	
117	217	870	435			Extension for reply within third month	
118	218	1,360	680			Extension for reply within fourth month	
128	228	1,850	925			Extension for reply within fifth month	
119	219	300	150			Notice of Appeal	
120	220	300	150			Filing a brief in support of an appeal	
121	221	260	130			Request for oral hearing	
138	138	1,510	1,510			Petition to institute a public use proceeding	
140	240	110	55			Petition to revive - unavoidable	
141	241	1,210	605			Petition to revive - unintentional	
142	242	1,210	605			Utility issue fee (or reissue)	
143	243	430	215			Design issue fee	
144	244	580	290			Plant issue fee	
122	122	130	130			Petitions to the Commissioner	
123	123	50	50			Petitions related to provisional applications	
126	126	240	240			Submission of Information Disclosure Stmt	\$40
581	581	40	40			Recording each patent assignment per property (times number of properties)	
146	246	690	345			Filing a submission after final rejection (37 CFR § 1.129(a))	
149	249	690	345			For each additional invention to be examined (37 CFR § 1.129(b))	
179	279	690	345			Request for Continued Examination (RCE)	
169	169	900	900			Request for expedited examination of a design application	

Other fee (specify) \_\_\_\_\_

\* Reduced by Basic Filing Fee Paid

**SUBTOTAL (3)** (\$) 40

## SUBMITTED BY

Name (Print/Type) Gary T. Hampson

Registration No. (Attorney/Agent) 29,929

## Complete (if applicable)

Telephone 714-773-6926

Signature Gary T. Hampson

Date October 09, 2000

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## **Fluid-Moving Device with a Clearance Seal**

### **Background of the Invention**

#### **Area of the Art**

5        The invention relates generally to fluid-tight dynamic seals between a reciprocating member and its housing. More particularly, the invention is directed to fluid-tight dynamic clearance seals and fluid-moving equipment utilizing such seals.

#### **Description of the Prior Art**

10       In many types of fluid-moving equipment, such as liquid pumps, slurry pumps, dry mixers, and numerous other devices, a sliding plunger, rod, piston, or another similar member, reciprocally moves inside a stationary bearing. Typically, fluid leakage around the moving member is prevented by utilizing sealing structures. The material of the sealing structure is required to have some resiliency and yet some degree of stiffness which will permit the moving member to slide back and forth  
 15       through the axial opening of the sealing structure and yet be tight enough to prevent or at least minimize leakage of the liquid around the moving member.

One type of a conventional sealing structure is a mechanical face seal. Typically, the mechanical face seal consists of one seal ring rotating with the driving shaft and one stationary seal ring attached to the surrounding housing. The two seal  
 20       rings are pressed towards each other by a biasing force which, in this way, prevents liquid from passing between them. For example, U.S. Pat. Nos. 3,282,235; 4,754,981; and 5,772,217 describe a seal with a spring for providing the biasing force. Usually, additional elastomeric components are required to seal each ring from the shaft or housing, correspondingly. Typically, a thin lubricating film is required between the  
 25       seal surfaces to prevent their damage by dry friction. Nevertheless, with time, wear and vibrations cause the mating faces of the sealing rings to become scored, resulting in leakage of the process fluid. Environments where the process fluid is abrasive or contains a coagulant are particularly damaging to the conventional seals and require their frequent replacement.

30       A packed stuffing box is another example of a conventional seal for a moving member. This type of seal has been disclosed, for example, in U.S. Pat. Nos. 3,659,862 and 5,333,883. Generally, the packing is sufficiently compressed to limit the passage of fluid through the packing, but not so compressed as to create excess friction

between the packing and the moving member. Pressure is generally maintained on the packing by manually tightening a gland on the stuffing box until the point where leakage through the packing is minimized, yet before the point where friction between the packing and the shaft creates overheating of the packing. Such a configuration operates on the principle of controlled leakage to the atmosphere rather than zero leakage. However, this requires frequent adjustment, and over tightening results in excess friction and heat buildup, excessive wear to the packing, and possibly even damage to the moving member. Even when the pressure on the packing is properly regulated, the pressure necessary to minimize the passage of fluid through the packing causes relatively high friction between the packing and the shaft. As a result, the packing wears out quickly and requires a frequent replacement.

Finally, referring to Figure 1, a combination of an elastomeric O-ring **1** with a spring preloaded polymer seal **2** has been utilized in the past to create a dynamic seal between a moving member, such as a piston **3**, and a housing structure. For example, Beckman Instruments (Fullerton, CA) uses this arrangement in the Access Immunoassay Analyzer. Typically, the housing structure includes a casing **4** and a piston-supporting bearing **5**. The polymer seal **2** prevents the fluid from flowing between the piston **3** and the bearing **5**, while the O-ring **1** seals off the housing. A preloading spring **6** forces the polymer seal **2** to squeeze directly on the piston **3** to accomplish the seal, thus resulting in wear of the polymer. The speed of the moving member and the fluid being sealed determines the required frequency of the polymer seal replacement.

Apparently, the sealing structures of prior art do not provide reliable and long-lasting seals between moving members and their housing. The conventional seals undergo a lot of wear during normal operation and have to be replaced frequently. The necessity to replace seals makes prophylactic maintenance of the equipment more laborious and increases its maintenance costs.

### **Summary of the Invention**

Accordingly, it is an object of the present invention to provide improved seals which avoid the undesirable features of the prior seals. Particularly, it is an object of the present invention to provide seals which have a low wear, may be produced at  
5 relatively low costs, and provide superior performance in use. It is a further object of the present invention to provide convenient fluid-moving devices utilizing such seals with relatively low maintenance cost and high reliability.

These and other objects are achieved in a clearance seal assembly of the present  
10 invention. The assembly comprises a stationary member defining a first side, a second side and an opening connecting the first and second side; a moving member moveably disposed through the opening; and a sealing member circumferentially disposed between the stationary member and the moving member. The sealing member has a fluid-tight relationship with the stationary member. The sealing member and the  
15 moving member define a continuous and uniform gap, having a size that allows the fluid to fill the gap but prevents the fluid from flowing through the gap from the first side to the second side of the opening under an operating pressure differential between the first and the second side. In a preferred embodiment, both the sealing member and the moving member are made of a ceramic material. The sealing assembly may also  
20 include a static seal disposed between the stationary member and the sealing member to allow a variable clearance therebetween while maintaining the fluid-tight relationship between the sealing member and the stationary member.

In another aspect, the invention provides a pump utilizing a clearance seal assembly. The pump comprises a housing structure having an internal wall defining a  
25 suction chamber for containing a fluid; a piston movably disposed within the chamber; and a sealing member circumferentially disposed between the housing structure and the piston. The sealing member has a fluid-tight relationship with the housing structure. The sealing member and the piston define a continuous and uniform gap. The gap has a size that allows the fluid to fill the gap but prevents the fluid from flowing through  
30 the gap from the suction chamber to an outside of the chamber under an operating fluid pressure.

By eliminating a direct contact between the sealing member and the moving member, the present clearance seal assembly alleviates many of the problems

associated with the conventional seals discussed above. In particular, the advantages of this approach include a minimal wear of the part, simplified assembly and maintenance, significantly improved reliability, and a decreased maintenance cost. The clearance seal of the present invention may be utilized in any device or system that requires drawing, moving, and dispensing of fluids. The invention may be particularly advantageous for use in high-precision pumps employed in analytical instrumentation. For example, a piston pump with a clearance seal manufactured in accordance with the present invention may be beneficially utilized for sample aspiration and dispensing in Nexgen Access System (Beckman Instruments, CA), disclosed in a U.S. patent application titled "Method and System for Automated Immunochemistry Analysis," which has been commonly assigned to the assignee of the present invention and relevant parts of which are incorporated by reference herein.

The invention is defined in the appended claims and is described below in its preferred embodiments.

## 15 **Description of the Figures**

The above-mentioned and other features of this invention and the manner of obtaining them will become more apparent, and will be best understood by reference to the following description, taken in conjunction with the accompanying drawings, in which:

20 Figure 1 is a cross-sectional view of a conventional piston seal assembly.

Figure 2 is a cross-sectional view of a clearance seal, according to one embodiment of the present invention.

Figure 3 is a cross-sectional view of a clearance seal, according to another embodiment of the present invention.

## 25 **Detailed Description of the Preferred Embodiments**

A conventional seal assembly 10 of a piston pump is shown in Figure 1. Typically, the piston pump includes a housing structure defining a suction chamber 100. The housing structure includes a stationary casing 4 and a stationary piston-supporting bearing 5. A piston 3 reciprocates within the suction chamber and is supported by the bearing 5 circumferentially disposed between the casing and the piston. The conventional seal assembly includes a spring-preloaded polymer seal 2 disposed between the bearing 5 and the piston 3. A preloading spring 6 forces the polymer seal 2 to squeeze on the piston 3 and the bearing 5 to form two sealing points,

7A and 7B, and to prevent a fluid from leaking into a clearance 8 between the piston and bearing. Typically, an additional elastomeric O-ring 1 is placed under a compression between the bearing 5 and the casing 4. The O-ring forms a sealing point 9A with the bearing and a sealing point 9B with the casing to prevent the fluid from running into a clearance 11 between the bearing and the casing. Consequently, the fluid fills the clearances 12 and 13 of the suction chamber 100, but cannot flow into clearances 8 and 11 on the outside of the chamber. However, as discussed above, due to the required contact between the stationary polymer seal 2 and the moving piston 3 at the sealing point 7A, the conventional seal assemblies suffer from rapid deterioration of the polymer seals and require their frequent replacement.

The present invention solves the problems of the prior art by providing a clearance seal, which does not require a direct contact between the piston and the sealing member. The clearance seal assembly of the present invention may be used in an association with any device having a stationary member with an opening and a moving member reciprocating through the opening. Examples of such devices include, but are not limited to, dispensing pumps, slurry pumps, and impeller pumps, used in a broad range of applications. The moving member may be, for example, a sliding plunger, rod, or piston. While a particular configuration of the invention may take on different or modified forms, a piston pump will be used to illustrate the invention in more detail.

Referring to Figure 2, a piston pump with a clearance seal assembly 20 of the present invention includes a stationary housing structure 21 with an internal wall 22 defining a suction chamber 23 for containing a fluid being pumped. A piston 24 is movably disposed within the suction chamber. A sealing member 25 is circumferentially disposed between the housing structure 21 and the piston 24 and has a fluid-tight relationship with the housing structure. The sealing member and the piston define a continuous and uniform gap 26. The gap 26 has a size that allows the fluid to fill the gap but prevents the fluid from flowing through the gap from the suction chamber to an outside of the chamber under an operating fluid pressure.

In this specification, "a fluid-tight relationship" between two structural elements means that the fluid cannot pass therebetween. It would be appreciated by those skilled in the art that any sealing method between the sealing member 25 and the

housing structure **21** may be used, as long as it provides a reliable seal. For example, in one embodiment shown in Figure 2, a fluid-tight relationship between the sealing member **25** and the housing structure **21** is accomplished by utilizing a removable elastomeric seal, such as an O-ring **27**. In another embodiment shown in Figure 3, the sealing member **25** is integrally formed with the housing structure **21**. In this embodiment, the sealing member may be molded together with the housing from the same material. Alternatively, the sealing structure may be made of a different material than the housing structure and attached to the housing. Means and methods of attachment of two members are well-known in the art and will not be discussed.

Referring to Figure 2, in this specification, a "continuous gap" means that the sealing member and the piston do not have any points of direct contact. A "uniform gap" means that the distance between the piston and an internal wall **28** of the sealing member does not vary significantly so as to compromise the hydraulic seal formed therebetween. It would be appreciated by those skilled in the art, that such a uniform gap requires closely controlled radial dimensions of an outer wall **29** of the piston and the internal wall **28** of the sealing member and a high assembling precision. Consequently, to simplify the control of the critical gap **26**, in the preferred embodiment, the cross-sections of the internal and the outer walls **28** and **29** have substantially circular shapes. Materials that have a high hardness and can be machined with a great precision may be used to make the sealing member and the piston and would be known to those of ordinary skill in the art in view of this disclosure. In one embodiment, both the sealing member and the piston are made of ceramic materials.

It is an unexpected discovery by the present inventors that a fluid seal can be formed between a moving and a stationary member without a direct contact therebetween. It has been observed that the size of the gap **26** may be selected to allow the fluid to fill the gap between the seal and piston, thus avoiding a dry friction, but to prevent the fluid from flowing through the gap. It may be hypothesized, that when the clearance gap is sufficiently small, the adhesive forces of the fluid toward the piston and the seal are greater than the force exerted by the fluid due to an operating pressure, thus preventing the fluid from flowing through the gap.

The ranges of suitable sizes of the gap **26** depend on the physical properties of the fluid being pumped, such as viscosity, surface tension, adhesive force, and operating pressure. Low viscosity fluids will typically require a smaller gap **26** than

higher viscosity fluids. Generally, the higher viscosity of a fluid, the broader range of the gaps **26** may be used. It should be recognized that the size of the gap greatly depends on a type of application. Those skilled in the art can easily select the size of the gap to accommodate fluids and operating pressures used in a particular application without undue experimentation in view of the instant disclosure.

The housing structure **21** of the pump of the present invention may include a casing **21A** defining the suction chamber **23** for accommodating the piston **24**, and a bearing **21B**, circumferentially disposed between the piston and the casing to support the piston. A static seal **27** may be further disposed between the casing and the sealing member to provide a fluid-tight relationship between the casing and the sealing member. Preferably, the static seal member is an annular elastomeric seal removably mounted under compression, forming a sealing point **31A** with the casing and a sealing point **31B** with the sealing member. Comparing Figures 1 and 2, it is apparent that the sealing assembly of the present invention is more reliable as it has fewer contact sealing points, which are potential sources of fluid leaks. Referring to Figure 2, it should be understood that a precise position of the static seal **27** is not important, as long as it prevents fluid from flowing between the housing structure and the sealing member.

Although the invention is described with a particular reference to a piston pump, it should be recognized that the general features of the clearance seal may be utilized in any device having a stationary member, such as the housing structure **21**, with an opening, such as suction chamber **23**, and a moving member, such as piston **24**, moveably disposed through the opening. Generally speaking, the stationary member may have any shape so long as it defines two volumes, such as inside and outside of the pump, referred to as two sides of the stationary member, and connected by the opening. The two volumes may contain different fluids and/or be under different pressure (e.g. operating fluid pressure inside the pump and atmospheric pressure outside the pump).

The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiment is to be considered in all respects only as illustrative and not as restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing

description. All changes which come within the meaning and range of the equivalence of the claims are to be embraced within their scope.

**What is Claimed is:**

1. A clearance seal assembly comprising:
  - a stationary member defining a first side, a second side and an opening connecting the first and second side;
  - a moving member moveably disposed through the opening; and
  - a sealing member circumferentially disposed between the stationary member and the moving member, the sealing member having a fluid-tight relationship with the stationary member, wherein the sealing member and the moving member define a continuous and uniform gap, having a size that allows the fluid to fill the gap but prevents the fluid from flowing through the gap from the first side to the second side of the opening under an operating pressure differential between the first and the second side.
2. The clearance seal assembly of claim 1, wherein the sealing member and the moving member are made of ceramic materials.
3. The clearance seal assembly of claim 1, wherein the gap is defined by an internal wall of the sealing member and an outer wall of the moving member, and cross-sections of the internal and the outer walls have substantially circular shapes.
4. The clearance seal assembly of claim 1, wherein the sealing member is integrally formed with the stationary member.
5. The clearance seal assembly of claim 1, wherein the sealing member is a separate element from the stationary member, the seal assembly further comprising a static seal disposed between the stationery and the sealing member to maintain the fluid-tight relationship therebetween.
6. The clearance seal assembly of claim 5, wherein the static seal is an annular elastomeric seal removably mounted on the sealing member.
7. A pump comprising:
  - a housing structure having an internal wall defining a suction chamber for containing a fluid;
  - a piston movably disposed within the chamber; and
  - a sealing member circumferentially disposed between the housing structure and the piston, the sealing member having a fluid-tight relationship with the housing structure, and the sealing member and the piston defining a continuous and uniform gap, wherein the gap has a size that allows the fluid to fill the gap but prevents the

fluid from flowing through the gap from the suction chamber to an outside of the chamber under an operating fluid pressure.

8. The pump of claim 7, wherein the sealing member and the piston are made of ceramic materials.

9. The pump of claim 7, wherein the housing structure comprises:  
a casing defining the suction chamber for accommodating the piston, and  
a bearing circumferentially disposed between the piston and the casing.

10. The pump of claim 9, further comprising a static seal disposed between the casing and the sealing member to maintain a fluid-tight relationship therebetween.

11. The pump of claim 10, wherein the static seal is an annular elastomeric seal removably mounted on the sealing member.

**ABSTRACT**

A clearance seal assembly is disclosed. The assembly comprises a stationary member defining a first side, a second side and an opening connecting the first and second side; a moving member moveably disposed through the opening; and a sealing member circumferentially disposed between the stationary member and the moving member. The sealing member has a fluid-tight relationship with the stationary member. The sealing member and the moving member define a continuous and uniform gap having a size that allows the fluid to fill the gap but prevents the fluid from flowing through the gap from the first side to the second side of the opening under an operating pressure differential between the first and the second side. In a preferred embodiment, both the sealing member and the moving member are made of a ceramic material. The sealing assembly may also include a static seal disposed between the stationary member and the sealing to allow a variable clearance therebetween while maintaining the fluid-tight relationship between the sealing member and the stationary member. A pump utilizing the sealing assembly of the present invention is also disclosed.

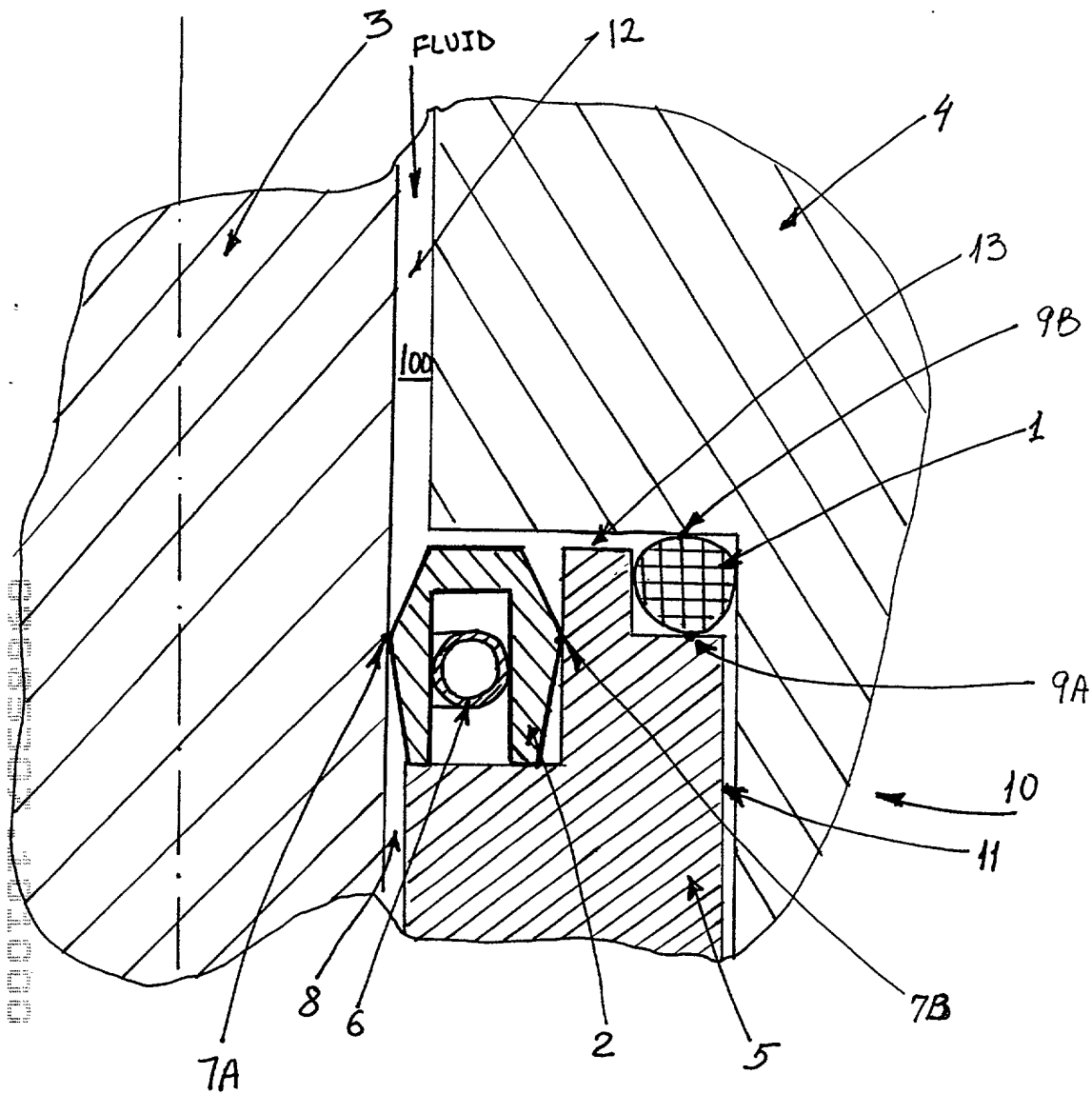


Figure 1

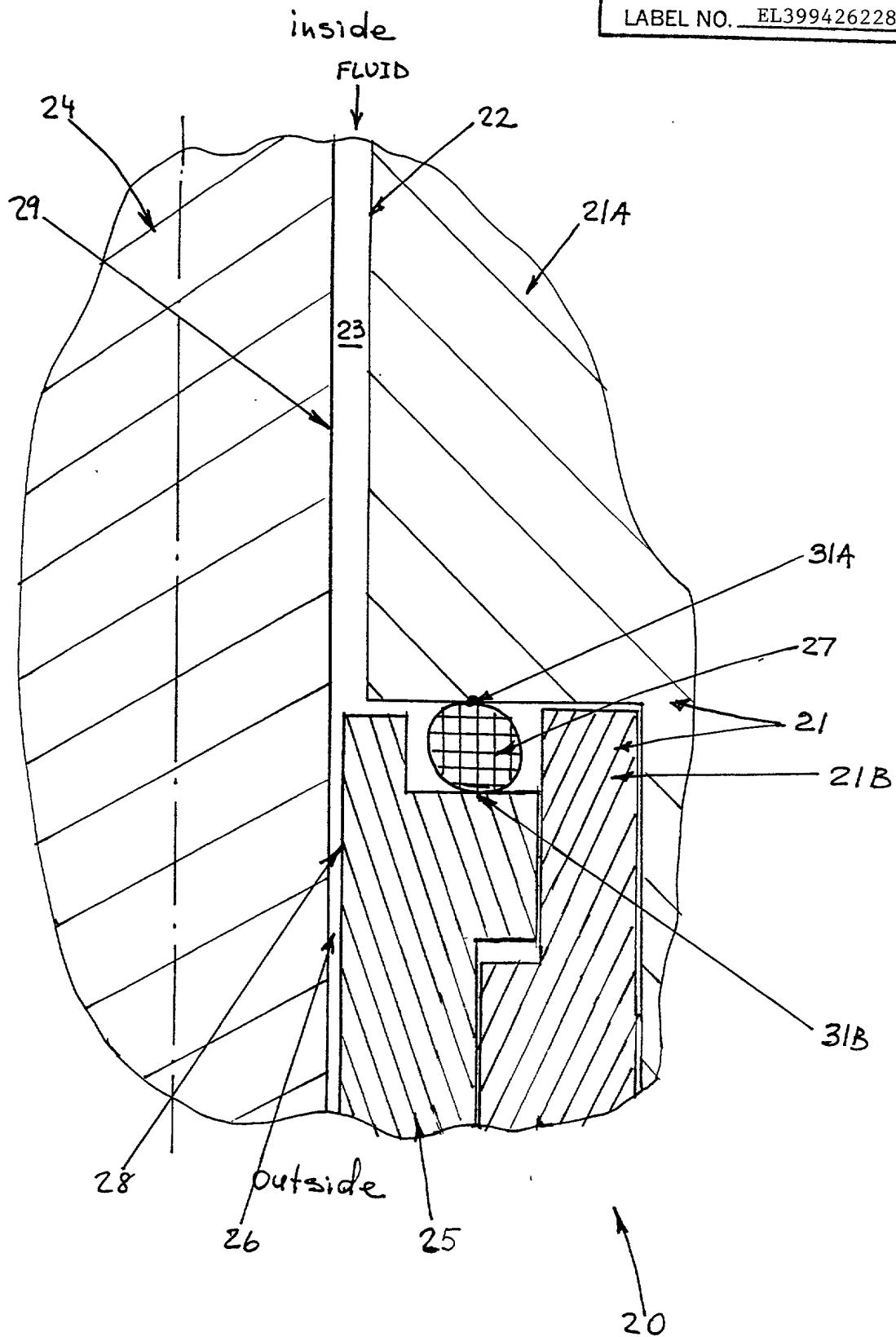


Figure 2

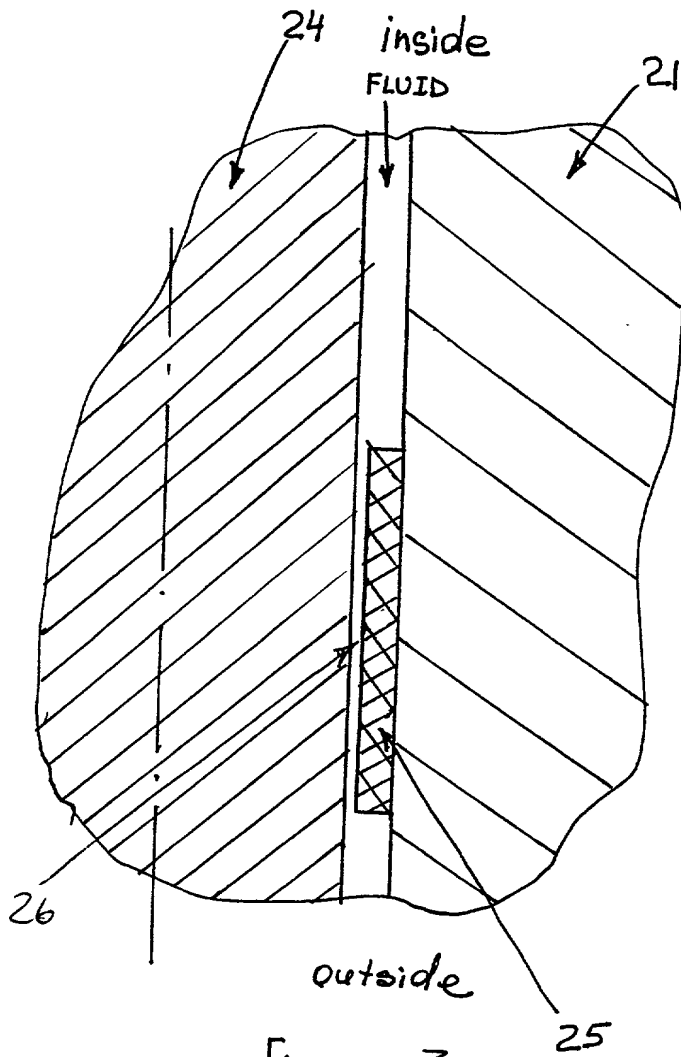


Figure 3

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PTO/SB/01 (12-97)

Approved for use through 9/30/00. OMB 0651-0032

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION</b> <b>(37 CFR 1.63)</b>  <input checked="" type="checkbox"/> Declaration Submitted with Initial Filing      OR <input type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	<b>Attorney Docket Number</b>	2028-174
	<b>First Named Inventor</b>	Mark J. Kittock
	<b>COMPLETE IF KNOWN</b>	
	<b>Application Number</b>	/
	<b>Filing Date</b>	October 10, 2000
	<b>Group Art Unit</b>	
	<b>Examiner Name</b>	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FLUID-MOVING DEVICE WITH A CLEARANCE SEAL

the specification of which *(Title of the Invention)*

☒ is attached hereto  
OR

☐ was filed on (MM/DD/YYYY) as United States Application Number or PCT International

Application Number and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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## DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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OR

☐ Registered practitioner(s) name/registration number listed below



Name	Registration Number	Name	Registration Number
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))		Family Name or Surname	
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☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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## DECLARATION

### ADDITIONAL INVENTOR(S) Supplemental Sheet

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Name of Additional Joint Inventor, if any:

☐ A petition has been filed for this unsigned inventor

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